

SPRING 2012

STANDARDS AND GUIDELINES

FOR

CONTAMINANTS IN MASSACHUSETTS DRINKING WATERS

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Department of Environmental Protection
Office of Research and Standards
One Winter Street
Boston, MA 02108



Department of Environmental Protection

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

RICHARD K. SULLIVAN JR.
Secretary

KENNETH L. KIMMELL
Commissioner

TO: Interested Parties

FROM: Carol Rowan West, Director, Office of Research and Standards

DATE: *Spring 2012*

RE: Massachusetts Drinking Water Standards and Guidelines

Attached is the latest list of the Massachusetts Drinking Water Standards and Guidelines. The last issue was sent out in May of 2011. There is one change regarding part of the US EPA Health Advisory for manganese. The lifetime Health Advisory for manganese contains a precautionary statement that “for infants younger than 6 months, the lifetime Health Advisory of 0.3 mg/L be used even for an acute exposure of 10 days...” This cautionary advice is provided to address potential heightened susceptibility of infants to manganese toxicity because of higher water consumption rates, undeveloped systems for regulating body content of manganese and the fact that infant formulas may contain elevated manganese which, coupled with elevated manganese concentrations in drinking water used to prepare formula, may expose infants to higher concentrations of manganese than necessary. MassDEP is extending US EPA’s age cutoff to one year out of concerns for formula use up to that age.

The standards and guidelines may not apply to all contaminant situations, so I urge you to continue to contact the Office of Research and Standards (ORS) with any questions regarding the application or interpretation of this information. Also, when a contaminant of interest is not on the list, please contact ORS for guidance (phone number 617-292-5998; email: michael.hutcheson@state.ma.us).

The list of Massachusetts standards and guidelines is available on the MassDEP Web Page at <http://www.mass.gov/dep/water/drinking/standards/dwstand.htm> with links to chemical-specific documentation. Users have the option of clicking on an individual chemical in the list to see the basis for the derivation of the drinking water criterion, along with other pertinent information. The Web Page also provides limits for some routinely used drinking water treatment chemicals. This information is presented in the Department’s Office of Research and Standards (ORS) documentation for the Immediate Action Levels for Water Treatment Plant Chemicals (formerly referred to as “Memorandum on Treatment Chemicals as Do Not Drink or Use Guidance” located at: <http://www.mass.gov/dep/water/laws/ialwtps.htm>).

I. Introduction

The Drinking Water List of Standards and Guidelines is a convenient compendium of guidance values available for evaluating contaminants in drinking water in Massachusetts. The list is designed to be used by individuals or groups concerned with the integrity of drinking water, for example, water suppliers, homeowners, environmental groups, government regulators, boards of health, or private consultants.

Under the Safe Drinking Water Act (SDWA), a state may be granted primacy for implementing the provisions of the SDWA. The Massachusetts Department of Environmental Protection (MassDEP) has primacy for implementation. As part of that primacy, MassDEP is responsible for ensuring the quality of Massachusetts public drinking waters.

Four primary types of guidance are available for assessing drinking water quality in the Commonwealth:

<u>Standards:</u>	Massachusetts Maximum Contaminant Levels (MMCLs)
<u>Guidelines:</u>	ORS Guidelines US EPA Health Advisories Secondary Maximum Contaminant Levels

II. Standards

The Massachusetts Maximum Contaminant Levels (MMCLs) listed in the drinking water regulations (310 CMR 22.00) consist of promulgated US EPA MCLs which have become effective, plus a few MCLs set specifically by Massachusetts. The standards are enforced by the Drinking Water Program (DWP). Massachusetts may adopt a more stringent standard than the US EPA based on an independent review of primary or secondary data. The regulations were last promulgated on December 25, 2009.

The MMCLs listed in 310 CMR 22.00 apply to water that is delivered to any user of a public water system as defined in 310 CMR 22.02. More specific definitions and applications are in the regulations. Private residential wells are not subject to the requirements of 310 CMR 22.00. However, these drinking water standards are recommended for the evaluation of private drinking water and are often used to evaluate private residential contamination, especially in Federal Superfund and M.G.L Chapter 21E activities.

III. Guidelines

ORS Guidelines

ORS issues guidance for chemicals other than those with Massachusetts MCLs in drinking water. These ORS guidance values are known as ORS Guidelines or ORSG and are usually developed for use by Departmental programs in the absence of any other federal standards or guidance. ORSG may be based upon US EPA IRIS toxicity values or derived based on a review and evaluation of all available data for the chemical of interest. Some ORSG may be based on US

EPA Health Advisories. Standards promulgated by the US EPA but not yet effective may also be included on the list of Massachusetts Drinking Water Guidelines. ORSG are updated when IRIS toxicity values change so as to reflect the current toxicological guidance for the chemical.

ORS uses methodology similar to that used by the US EPA's Office of Groundwater and Drinking Water (OGWDW) when setting guidelines for chemicals in drinking water. Concentrations of chemicals having evidence of carcinogenicity are minimized as much as feasible; therefore, guidelines are set at a target excess lifetime cancer risk of one in one million (1×10^{-6}) or at the lowest practical quantitation limit (PQL) if the concentration at 1×10^{-6} is below the PQL. This practice applies to chemicals classified as A or B carcinogens under the old cancer classification scheme of US EPA (US EPA, 1986). Class C carcinogens are individually evaluated for a decision regarding whether to set the guidelines on cancer effects. For newly classified carcinogens under US EPA's new Carcinogen Risk Assessment Guidelines (US EPA, 2005), MassDEP will follow US EPA OGWDW's procedures for development of guidance.

To derive guidance for potential non-carcinogenic effects for a chemical, ORS applies a percentage (usually 20%) to published or derived route-specific reference doses and then uses standard exposure assumptions to convert the dose to a drinking water concentration. This practice allows for the possibility of human exposures from sources other than drinking water.

US EPA Health Advisories

The US EPA provides drinking water guidance in the form of Health Advisories for different durations of exposure (i.e., one-day, ten-day and lifetime). These are based upon non-cancer health effects. They are used by MassDEP when evaluating the potential health risks from chemicals in drinking water when no MMCL or ORSG is available.

Secondary Maximum Contaminant Levels (SMCLs)

SMCLs are guidance values issued by the US EPA representing levels of chemicals or parameters above which the aesthetic properties of the water can be affected (e.g., taste, odor, color) or cosmetic effects may occur (e.g., skin or tooth discoloration).

For more information

A more detailed description of the methodology used by ORS to derive water guidance can be found in Guide to the Regulation of Toxic Chemicals in Massachusetts Waters (ORS, 1990), available on MassDEP's website at: <http://mass.gov/dep/water/laws/dwgguide.doc>.

IV. Spring 2012 Drinking Water Standards and Guidelines Lists Update

<u>Changes to the 2012 List of Drinking Water Standards and Guidelines</u>		
Contaminant	Description of Change or Notation	Basis for Change or Notation
Manganese	ORS has added a notation to the link to the US EPA list of Health Advisories regarding a recommended change in part of the Health Advisory language for manganese. Manganese has been listed under ORS guidelines with a cross reference to the SMCL and US EPA HA.	US EPA recommends that the lifetime HA value of 0.3 mg/L be used for infants up to 6-months of age even for an acute exposure of 10 days. This cautionary advice is provided to address potential heightened susceptibility of infants to manganese toxicity because of higher water consumption rates, undeveloped systems for regulating body content of manganese and the fact that infant formulas may contain elevated manganese which, coupled with elevated manganese concentrations in drinking water used to prepare formula, may expose infants to higher concentrations of manganese than necessary. MassDEP is extending US EPA's age cutoff to one year out of concerns for formula use up to that age.

V. References

Office of Research and Standards, 1990. *Guide to the Regulation of Toxic Chemicals in Massachusetts Waters*. Massachusetts Department of Environmental Protection. Boston, MA.

US EPA (US Environmental Protection Agency). 2005. Guidelines for Carcinogen Risk Assessment. EPA/630/P-03/001F. Risk Assessment Forum. US Environmental Protection Agency. Washington, D.C.

US EPA (US Environmental Protection Agency). 1986. Guidelines for Carcinogen Risk Assessment. Risk Assessment Forum. US Environmental Protection Agency. Washington, D.C.

SPRING 2012**MASSACHUSETTS DRINKING WATER STANDARDS – Inorganic and Organic Chemicals**

Please note that drinking water guidance is contained in five separate lists, in the following order:

- (1) Massachusetts Maximum Contaminant Levels – Inorganic/Organics; (2) Massachusetts Maximum Contaminant Levels – Radionuclides;
(3) Massachusetts Maximum Contaminant Levels – Biologicals; (4) Massachusetts Drinking Water Guidelines (ORSG);
(5) Secondary Maximum Contaminant Levels

SUBSTANCE	CASRN	MMCL (mg/L)
Acrylamide ¹	79061	Treatment Technique
Alachlor	15972608	0.002
Antimony	7440360	0.006
Arsenic	7440382	0.010
Asbestos ²	1332214	7 million fibers/liter
Atrazine	1912249	0.003
Barium	7440393	2
Benzene	71432	0.005
Benzo(a)pyrene	50328	0.0002
Beryllium	7440417	0.004
Bromate	15541454	0.010
Cadmium	7440439	0.005
Carbofuran	1563662	0.04
Carbon tetrachloride	56235	0.005
Chloramines (as Cl ₂)	N/A	4.0 (MRDL ³)
Chlordane	57749	0.002
Chlorine (as Cl ₂)	7782505	4.0 (MRDL)
Chlorine dioxide (as ClO ₂)	10049044	0.8 (MRDL)
Chlorite	7758192	1.0
Chlorobenzene	108907	0.1
Chromium (total)	7440473	0.1
Copper	7440508	Treatment Technique, 1.3 (Action Level)

MASSACHUSETTS DRINKING WATER STANDARDS – Inorganic and Organic Chemicals

SUBSTANCE	CASRN	MMCL (mg/L)
Cyanide (as free cyanide)	57125	0.2
2,4-D (2,4-Dichlorophenoxyacetic acid)	94757	0.07
Dalapon	75990	0.2
1,2-Dibromo-3-chloropropane (DBCP)	96128	0.0002
1,2-Dichlorobenzene (o-DCB)	95501	0.6
1,4-Dichlorobenzene (p-DCB) ⁴	106467	0.005
1,2-Dichloroethane	107062	0.005
1,1-Dichloroethylene	75354	0.007
1,2-Dichloroethylene(<i>cis</i>)	156592	0.07
1,2-Dichloroethylene(<i>trans</i>)	156605	0.1
Dichloromethane	75092	0.005
1,2-Dichloropropane	78875	0.005
Di(2-ethylhexyl)-adipate	103231	0.4
Di(2-ethylhexyl)-phthalate	117817	0.006
Dinoseb	88857	0.007
Diquat	85007	0.02
Endothall	145733	0.1
Endrin	72208	0.002
Epichlorohydrin ⁵	106898	Treatment Technique
Ethylbenzene	100414	0.7
Ethylene dibromide (EDB) ⁶	106934	0.00002
Fluoride ⁷	7782414	4.0
Glyphosate	1071536	0.7

MASSACHUSETTS DRINKING WATER STANDARDS – Inorganic and Organic Chemicals

SUBSTANCE	CASRN	MMCL (mg/L)
Haloacetic acids (HAA5) (for chlorinated supplies only): including monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, bromoacetic acid and dibromoacetic acid	N/A	0.060
Heptachlor	76448	0.0004
Heptachlor epoxide	1024573	0.0002
Hexachlorobenzene	118741	0.001
Hexachlorocyclopentadiene	77474	0.05
Lead	7439921	Treatment Technique, 0.015 (Action Level)
Lindane	58899	0.0002
Mercury (inorganic)	7439976	0.002
Methoxychlor	72435	0.04
Nitrate (As N)	14797558	10
Nitrate/Nitrite (total)	N/A	10
Nitrite (As N)	14797650	1
Oxamyl (Vydate)	23135220	0.2
PCBs (Polychlorinated biphenyls) ⁸	1336363	0.0005
Pentachlorophenol	87865	0.001
Perchlorate ⁹		0.002
Picloram	1918021	0.5
Selenium	7782492	0.05
Simazine	122349	0.004
Styrene	100425	0.1
2,3,7,8-TCDD (Dioxin)	1746016	3 x 10 ⁻⁸
Tetrachloroethylene	127184	0.005
Thallium	7440280	0.002
Toluene	108883	1

MASSACHUSETTS DRINKING WATER STANDARDS – Inorganic and Organic Chemicals

SUBSTANCE	CASRN	MMCL (mg/L)
Total trihalomethanes (for chlorinated supplies only)	N/A	0.080
Including: Chloroform	67663	N/A ¹⁰
Chlorodibromomethane	124481	N/A
Bromodichloromethane	75274	N/A
Bromoform	75252	N/A
Toxaphene	8001352	0.003
2,4,5-TP (Silvex)	93721	0.05
1,2,4-Trichlorobenzene	120821	0.07
1,1,1-Trichloroethane	71556	0.2
1,1,2-Trichloroethane	79005	0.005
Trichloroethylene	79016	0.005
Vinyl chloride	75014	0.002
Xylenes (total)	1330207	10

¹ No numerical MCL is provided for these compounds. If detected, a treatment technique is specified. Each water system must certify, in writing, to the state (using third-party or manufacturer's certification) that when acrylamide and epichlorohydrin are used in drinking water systems, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows:

- Acrylamide = 0.05% dosed at 1 mg/L (or equivalent)
- Epichlorohydrin = 0.01% dosed at 20 mg/L (or equivalent)

² For fibers longer than 10 microns.

³ MRDL = maximum residual disinfectant level - the highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

⁴ The MMCL for this chemical is more stringent than the federal MCL.

⁵ See footnote 1 above.

⁶ See footnote 4 above.

⁷ The U.S. Environmental Protection Agency (US EPA) completed a scientific assessment of fluoride in response to a 2006 National Academy of Sciences (NAS) report recommending that US EPA update its fluoride health and exposure assessments to take into account bone and dental effects and to consider all sources of fluoride. Based upon the NAS and US EPA information and its own independent assessment, the U.S. Health and Human Services (HHS) recently recommended lowering the non-regulatory HHS limit for fluoride in drinking water to 0.7 mg/L, the lowest end of its previous recommended range of

0.7-1.2 mg/L. US EPA is currently considering whether to lower its fluoride MCL of 4 mg/L.

(<http://www.hhs.gov/news/press/2011pres/01/20110107a.html>).

⁸ The MCL for PCBs applies to the decachlorobiphenyl species.

⁹ The MCL is directed at the sensitive subgroups of pregnant women, infants, children up to the age of 12, and individuals with hypothyroidism. They should not consume drinking water containing concentrations of perchlorate exceeding 2 µg/L.

MassDEP recommends that no one consume water containing perchlorate concentrations greater than 18 µg/L.

¹⁰ Not applicable

SPRING 2012**MASSACHUSETTS DRINKING WATER STANDARDS – Radionuclides**

Please note that drinking water guidance is contained in five separate lists, in the following order:
(1) Massachusetts Maximum Contaminant Levels – Inorganic/Organics; (2) Massachusetts Maximum Contaminant Levels – Radionuclides;
(3) Massachusetts Maximum Contaminant Levels – Biologicals; (4) Massachusetts Drinking Water Guidelines (ORSG);
(5) Secondary Maximum Contaminant Levels

SUBSTANCE	CASRN	TYPE OF GUIDANCE	MMCL (mg/L)
Beta particle and photon radioactivity	N/A	MMCL	concentration which produces an annual dose of 4 millirem/yr
Gross alpha radiation	N/A	MMCL	15 pCi/L
Radium (226 + 228)	7440144	MMCL	5 pCi/L
Radon-222 ¹	14859677	ORSG	10,000 pCi/L (ORSG)
Uranium	7440611	MMCL	0.030

¹ Exceedance of this guideline indicates that indoor air sampling for Radon-222 should be done. US EPA proposed guidelines for radon (64 FR 211; Tuesday, November 2, 1999) which have not been finalized.

SPRING 2012**MASSACHUSETTS DRINKING WATER STANDARDS – Biologicals**

Please note that drinking water guidance is contained in five separate lists, in the following order:
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(3) Massachusetts Maximum Contaminant Levels – Biologicals; (4) Massachusetts Drinking Water Guidelines (ORSG);
(5) Secondary Maximum Contaminant Levels

SUBSTANCE	CASRN	MMCL
<i>Cryptosporidium</i>	N/A	Treatment Technique
<i>Giardia lamblia</i>	N/A	Treatment Technique
Heterotrophic plate count	N/A	Treatment Technique
<i>Legionella</i>	N/A	Treatment Technique
Total coliform bacteria (including fecal coliform and <i>E. coli</i>)	N/A	refer to 310 CMR 22.05
Turbidity	N/A	Treatment Technique
Viruses (enteric)	N/A	Treatment Technique

SPRING 2012**MASSACHUSETTS DRINKING WATER GUIDELINES**

Please note that drinking water guidance is contained in five separate lists, in the following order:
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 (5) Secondary Maximum Contaminant Levels

SUBSTANCE	CASRN	ORSG (mg/L)
Acetone	67641	6.3
Aldicarb ¹	116063	0.003
Aldicarb sulfone ²	1646884	0.002
Aldicarb sulfoxide ³	1646873	0.004
Bromomethane	74839	0.01
Chloroform ⁴	67663	0.07
Dichlorodifluoromethane	75718	1.4
1,1-Dichloroethane	75343	0.07
1,3-Dichloropropene	542756	0.0004
1,4-Dioxane	123911	0.0003
Ethylene glycol	107211	14
Manganese ⁵	7439965	see endnote
Methyl ethyl ketone	78933	4.0
Methyl isobutyl ketone	108101	0.35
Methyl <i>tertiary</i> butyl ether ⁶	1634044	0.07
Metolachlor	51218452	0.1
Naphthalene	91203	0.140
Nickel ⁷	7440020	0.1
n-Nitrosodimethylamine (NDMA)	62759	0.00001

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MASSACHUSETTS DRINKING WATER GUIDELINES

SUBSTANCE	CASRN	ORSG (mg/L)
Petroleum hydrocarbons ⁸	N/A	
TPH		0.2
<u>Aliphatics</u>		
C ₅ -C ₈		0.3
C ₉ -C ₁₂ ⁹		0.7
C ₉ -C ₁₈ ¹⁰		0.7
C ₁₉ -C ₃₆		14.0
<u>Aromatics</u>		
C ₆ -C ₈		use guidance for individual chemicals
C ₉ -C ₁₀		0.2
C ₁₁ -C ₂₂		0.2
Sodium ¹¹	7440235	20
Tertiary-Amyl Methyl Ether (TAME)	994058	0.09
Tertiary Butyl Alcohol (TBA)	75650	0.12
Tetrahydrofuran ¹²	109999	1.3
1,1,2-Trichloro-1,2,2-trifluoroethane (FREON 113)	76131	210

All guidelines are current with the information listed in IRIS as of May 1, 2012 except where noted.

¹ The MCLs for aldicarb, aldicarb sulfone and aldicarb sulfoxide have been stayed.

² See footnote 1 above.

³ See footnote 1 above.

⁴ This guideline applies to non-chlorinated water supplies. For chlorinated drinking water supplies, please contact the Drinking Water Program.

⁵ See Secondary Maximum Contaminant Level listing on p. 14 and US EPA Health Advisory reference and modification on p. 15.

⁶ The health-based guideline for MTBE was reviewed by ORS in 2000.

⁷ The MCL for Nickel has been remanded and is no longer in effect, however the current US EPA IRIS chronic oral reference dose for soluble salts of nickel (<http://www.epa.gov/iris/subst/0271.htm>) supports this value and it is also the currently listed US EPA Life-time Health Advisory value (<http://www.epa.gov/waterscience/criteria/drinking/standards/dwstandards.pdf>).

⁸ Monitoring for these compounds is not required but is done on a case-by-case basis. These limits may be used when evaluating health risks posed by clearly identified mixtures of petroleum hydrocarbon compounds. The analytical methods to use to generate data to compare to the Drinking Water Guidelines are the Volatile Petroleum Hydrocarbon (VPH) and the Extractable Petroleum Hydrocarbon (EPH) methods developed by the MassDEP (MassDEP 1998).

⁹ The overlap in the C₉-C₁₂ range is the result of the VPH and EPH analytical methods used to quantitate these ranges of petroleum hydrocarbons in drinking water. The choice of the most appropriate range to use is based on the identity of the petroleum product of concern and is therefore determined on a case-specific basis.

¹⁰ See footnote 9 above.

¹¹ All detections of sodium must be reported. Please refer to 310 CMR 22.06A for the specific requirements. The sodium guideline of 20 mg/L is based on an eight (8) ounce serving.

¹² IRIS has updated the toxicity values for tetrahydrofuran. They are currently under review by ORS.

SPRING 2012
SECONDARY MAXIMUM CONTAMINANT LEVELS

Please note that drinking water guidance is contained in five separate lists, in the following order:
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 (3) Massachusetts Maximum Contaminant Levels – Biologicals; (4) Massachusetts Drinking Water Guidelines (ORSG);
 (5) Secondary Maximum Contaminant Levels

Chemicals/Parameter	Status	SMCL (mg/L)
Aluminum	F ¹	0.05 to 0.2
Chloride	F	250
Color	F	15 Color Units
Copper	F	1.0
Corrosivity	F	non-corrosive
Fluoride	F	2.0
Foaming agents	F	0.5
Iron	F	0.3
Manganese	F	0.05
Methyl <i>tertiary</i> butyl ether ²	A ³	0.020-0.040
Odor	F	3 threshold odor numbers
pH ⁴	F	6.5 - 8.5
Silver	F	0.10
Sulfate	F	250 ⁵
Total dissolved solids (TDS)	F	500
Zinc	F	5

Secondary Standards are referenced in the Massachusetts Drinking Water Regulations (310 CMR 22.07 (d)).

¹ Final

² The secondary MCL for MTBE is based on the Drinking Water Advisory set by US EPA and is based on taste and odor considerations.

³ Advisory

⁴ This range of values is set to avoid adverse aesthetic impacts. Alternate system-specific values for pH may be generated for other program areas (e.g., Lead and Copper Rule water quality parameters; Immediate Action Level for Water Treatment Plant Chemicals).

⁵ An MCL of 500 mg/L has been proposed by US EPA (Federal Register 12/20/94).

SPRING 2012
US EPA HEALTH ADVISORIES

A tabular compilation of **US EPA Health Advisories may be obtained at:
<http://water.epa.gov/action/advisories/drinking/upload/dwstandards2012.pdf>.

****Notation Regarding Manganese:** The lifetime Health Advisory for manganese contains a precautionary statement that “for infants younger than 6 months, the lifetime Health Advisory of 0.3 mg/L be used even for an acute exposure of 10 days, because of the concerns for differences in manganese content in human milk and formula and the possibility of a higher absorption and lower excretion in young infants.” MassDEP is extending that age to one year out of concerns for formula use up to that age and the potential susceptibility of this early life stage to excessive manganese exposure and potential resultant toxicity.